U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: Artemisia campestris var. wormskioldii

COMMON NAME: Northern wormwood

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: October 2005

STATUS/ACTION
___ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status
___ New candidate
_X_ Continuing candidate
___ Non-petitioned
_X_ Petitioned - Date petition received: May 11, 2004
90-day positive - FR date:
12-month warranted but precluded - FR date:
Did the petition request a reclassification of a listed species? No

FOR PETITIONED CANDIDATE SPECIES:
a. Is listing warranted (if yes, see summary of threats below)? yes
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes
c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, almost our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations, and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov/).
NA Listing priority change
Former LP: ___

New LP: ___

Date when the species first became a Candidate (as currently defined): October 25, 1999

___ Candidate removal: Former LPN: NA

___ A Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F Range is no longer a U.S. territory.

___ I Insufficient information exists on biological vulnerability and threats to support listing.

___ M Taxon mistakenly included in past notice of review.

___ N Taxon does not meet the Act's definition of "species."

___ X Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Plant; Asteraceae (aster family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Oregon, Washington

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Washington

LAND OWNERSHIP

One hundred percent of the known populations are on Federal land. The Klickitat County population occurs on Miller Island, which is managed by the Columbia River Gorge National Scenic Area of the Gifford Pinchot National Forest. The Grant County population occurs on land owned and managed by the Bureau of Reclamation and the Grant County Public Utilities District (PUD) along the shore of the Columbia River and on several peninsulas that become "islands" during periods of high water.

LEAD REGION CONTACT: Paul Phifer (503) 872-2823

LEAD FIELD OFFICE CONTACT: Western Washington Fish and Wildlife Office, Ted Thomas (360) 753-4327 or Deanna Lynch (360) 753-9545.

BIOLOGICAL INFORMATION:

Species Description

Artemisia campestris var. wormskioldii is a perennial plant in the aster family (Asteraceae). Also commonly known as Pacific sagebrush, A. c. var. wormskioldii is a low-growing plant, generally 15–30 centimeters (cm) (6–12 inches (in)) tall, but may grow up to 40 cm (16 in) in height. This plant has a taproot, and basal leaves are crowded in rosettes. The basal leaves are

2–10 cm (1–4 in) long and divided two or three times in mostly linear divisions. Leaves on the upper stems are similar but smaller and less divided. The stems and leaves are conspicuously covered with silky hairs. The fruits (achenes) and the enlarged upper ends of the flower-bearing stalks (receptacles) are without hairs. The arrangement (inflorescence) of yellowish flowers on the stem is narrow, and the involucres are about 0.3–0.5 cm (0.1–0.2 in). The flower heads are relatively large. The outer female flowers are fertile, and the sterile disk flowers have undeveloped ovaries (Hitchcock et al. 1955; Carlson 1997; Washington Natural Heritage Program and Bureau of Land Management 1999).

Taxonomy

Artemisia campestris var. wormskioldii was first collected along the Columbia River by David Douglas and described in 1833 by W. S. J. G. von Besser as A. borealis var. wormskioldii. The variety is distinguished by having larger floral parts than other Artemisia and it is the only Artemisia that flowers in April and May (Caplow 2005). After several taxonomic changes, A. campestris var. wormskioldii is the currently accepted taxonomic name for northern wormwood, as used by Chambers and Sundberg (2000). A. campestris var. wormskioldii was the taxonomic name ascribed to the variety at the time it was originally determined to be a candidate species in 1999 (64 FR 57534). In the 1999, 2001, 2002, 2004 CNOR the taxon was referred to as A. campestris var. wormskioldii. In the 2005 CNOR, a synonym, A. campestris ssp. borealis var. wormskioldii was used.

The nomenclature used by Chambers and Sundberg (2000) is widely accepted. The taxon, Artemisia campestris var. wormskioldii is valid by the standards of the International Code of Botanical Nomenclature (aka St. Louis Code 1999). This name has been confirmed as the correct name by several botanical experts: (Dr. David Giblin, Herbarium curator, University of Washington, pers. comm. 2006; Dr. Thomas Kaye, Botanical Consultant, Institute of Applied Ecology, pers. comm. 2006)). Some authorities have used Artemisia campestris ssp. borealis var. wormskioldii (Hitchcock and Cronquist 1973; Kartesz 1994), which is considered to be synonymous with A. campestris var. wormskioldii. The most recent treatment by the Integrated Taxonomic Information System (2006) uses A. campestris var. wormskioldii as the accepted name for this taxon.

Habitat

Artemisia campestris var. wormskioldii is restricted to exposed basalt, cobbly-sandy terraces, and sand habitat along the banks of the Columbia River at elevations ranging from 50 to 150 meters (160 to 500 feet). The Klickitat County, Washington, population is found near water level in the crevices of basalt outcrops, compacted cobbly terrace, and sand. The Grant County, Washington, population occurs along the shore of the Columbia River and on several “islands” composed mostly of compacted cobbly terrace (Rush 1999). This population appears to be restricted to an area of compacted cobbles with varying amounts of sand and little, if any, soil development (Carlson 1997).

Historical Range/Distribution

Historically, at least eight populations of Artemisia campestris var. wormskioldii occurred within the range of this variety. This plant was previously collected from sites along the banks of the Columbia River near the mouth of the John Day River in Wasco County, Oregon, to the vicinity of Hood River in Hood River County, Oregon, a distance of 80 kilometers (km) (50 miles (mi)) (Washington Natural Heritage Program and Bureau of Land Management 1999). All of the historical locations have been surveyed, and no populations were found. It is likely that disturbances due to the construction of several dams and subsequent flooding of habitat resulted in the extirpation of the historical occurrences (Carlson 1997; Rush 1999).

Current Range/Distribution

Currently, Artemisia campestris var. wormskioldii is known from only two sites along the Columbia River, separated by approximately 322 km (200 mi), in Klickitat and Grant Counties, Washington. These two populations were discovered in 1983 (Carlson 1997). Three large hydroelectric dam/reservoir complexes (Priest Rapids Dam, McNary Dam, and John Day Dam) separatethe two sites (Carlson 1997; Rush 1999). Both populations are found just downstream of dams where current habitat most resembles historic habitat. There may be little or no suitable habitat between the two known populations because much of the original river bank has been inundated by the construction of the three dams and the use of riprap along the river banks; however, remnant populations may remain (Carlson 1997).

Although potential habitat is found on the Hanford Reach of the Columbia River, surveys of apparently suitable habitat have not detected any Artemisia campestris var. wormskioldii plants. In 2002, intensive surveys of the islands in the Hanford Reach by staff from the Washington Natural Heritage Program and the Hanford Reach National Monument found no additional populations of A. c. var. wormskioldii (Florence Caplow, Washington Department of Natural Resources (WDNR), pers. comm. 2002).

Population Estimates/Status

At the Klickitat County site in 1989, 75 plants occupied less than 0.4 hectare (ha) (1 acre (ac)) (Kaye 1995). In 1995, Kaye (1995) documented 109 flowering plants. The majority of the plants were found on a sandy substrate above basalt bedrock; 16 plants were found on bedrock. A June 1999 census documented 142 flowering plants (Rush 1999). In 2002, 104 flowering plants were found on both sand and bedrock. Surveys in 2003 documented 82 flowering plants on both sand and bedrock. Surveys in 2004 documented 84 flowering plants on sand and 3 plants on bedrock. Initial census figures for 2005 are 71 flowering plants (Caplow 2005). Demographic monitoring indicates this population declined between 2002 and 2004 and had low population growth rates (0.759 in 2002-2003 and 0.89 in 2003-2004) (Caplow 2005). Small vegetative plants experienced the highest mortality (up to 68 percent) (Caplow 2005). Large reproductive plants were the most significant contributors to seedling recruitment; however, 0.2 seedlings per plant is extremely low compared to results for the Grant County site (1.4 – 14.7

seedlings per large reproductive plant) (Caplow 2005). If population trends continue at this site, the 25-year extinction probability at the site is 1.0 and extinction will occur within 25 years (Caplow 2005).

At the Grant County site, a monitoring project was established in 2001 in the largest subpopulation of 1,260 plants. Within the 31 monitoring plots, 179 Artemisia campestris var. wormskioldii individuals were mapped in 2001, and 150 of these were observed in 2002. In the same plots, 157 individuals of A. c. var. scouleriana were mapped in 2001, and 128 of these were observed in 2002. Fourteen new A. c. var. wormskioldii seedlings were observed in 2002. However, only six seedlings were observed in 2001, because these plants were not individually monitored it is unclear whether they survived to the next year of monitoring and could be counted as recruitment into the population. The largest reproductive plants were most important for population growth. Although analysis of the data from 2001 through 2002 indicated a decline, analysis of data from 2002 through 2003 did not indicate a decline (F. Caplow, pers. comm. 2004). During monitoring of plots at the Beverly site in 2004, 66 flowering plants were counted. The number of nonflowering plants counted, including seedlings, was 355 individuals (F. Caplow, pers comm. 2004). Census results from 2005 indicate between 1,623 and 1,710 flowering adults in the main population and 155 in the three sub-populations (Mike Clement, Grant County PUD, pers. comm. 2005). Preliminary demographic results suggest some vulnerability to environmental variability (Caplow 2005). The annual variability of plant reproduction and the number of adult plants is high (Tom Kaye, pers comm. 2006). M. Clement (pers comm. 2006) indicated that moisture and temperature in any given year is highly variable and that these factors directly affect the ability of plants to produce seed and for seed to germinate and to survive into a mature flowering plant.

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

The construction of dams along the Columbia River, and possibly railroad and highway construction, resulted in the direct loss of suitable habitat as well as individuals and populations of Artemisia campestris var. wormskioldii (Carlson 1997). Losses of habitat and individuals probably resulted from both disturbances due to dam construction and the resulting inundation. Much of the existing river bank is riprap, which is not suitable habitat (Carlson 1997; Rush 1999).

Erosion by wind and water of the sandy substrate has been observed throughout the Klickitat County site and is causing mortality of adult plants and decreased seedling survival (Caplow 2005). Erosion of the habitat is the primary threat to Artemisia campestris var. wormskioldii at the Klickitat County site (F. Caplow, pers. comm. 2005; R. Dobson US Forest Service, pers. comm. 2006).

Recreational use at both the Klickitat County and Grant County sites leads to trampling of plants. The Grant County site has been affected by recreational use, including picnicking, camping,

hunting, fishing and vehicular traffic. Although the Grant County site is now entirely fenced to exclude vehicles, the site is still accessible to boats (F. Caplow, pers. comm. 2002) and some walk-in use still occurs (Grant County PUD 2006). Therefore, the fencing at the Grant County site has reduced the threat of trampling, but has not entirely eliminated it. At the Klickitat County site, the Artemisia campestris var. wormskioldii population is immediately adjacent to a beach suitable for landing a boat (Carlson 1997; Rush 1999). The small size of the Klickitat County population and its proximity to the boat landing site make it particularly vulnerable to trampling pressure (F. Caplow, pers. comm. 2005).

Two years of above annual rainfall in 1996 and 1997, high runoff, and likely higher than normal releases of water from the upstream Grand Coulee and Wanapum Dams produced excessively high water levels on the Columbia River at the Grant County population (Rush 1999). The high water levels may have washed away Artemisia campestris var. wormskioldii from the site. Conditions that create high annual rainfall, which require excessive water releases from the Dams are not predictable but may occur at times in the future.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

There is no evidence that Artemisia campestris var. wormskioldii has been used for commercial or recreational purposes. Several cuttings have reportedly been taken from the Klickitat County population (Carlson 1997); however, there is no evidence that cuttings have been made recently. Overutilization for scientific or educational purposes is not known to occur at either population.

C. Disease or predation.

There is no evidence that disease or predation is a concern for Artemisia campestris var. wormskioldii, although herbivory (cattle grazing) could be a threat. The Klickitat County population was within an area formerly grazed by cattle (Carlson 1997). While the palatability of this variety is not known, some individual plants growing in a very loose substrate (sand) are easily uprooted by cattle. Disturbance of the habitat by cattle grazing also may have contributed to the increase of nonnative plant species (Carlson 1997). There is no evidence that cattle grazing has occurred at the Grant County site.

D. The inadequacy of existing regulatory mechanisms.

Artemisia campestris var. wormskioldii is designated as endangered by the states of Oregon and Washington (Washington Natural Heritage Program 2005; Oregon Department of Agriculture (OAR 603–073–0070)). There is, however, no State Endangered Species Act and no existing State regulatory mechanisms that provide protection for this taxon in Washington. Artemisia campestris var. wormskioldii is listed as endangered under the Oregon Endangered Species Act. However, the variety is found entirely in Washington State and there is no state protection given to this variety for the populations on Miller Island or near Beverly.

Artemisia campestris var. wormskioldii is managed as a sensitive species by the U.S. Forest Service (Forest Service), which provides management direction for the Klickitat County population (R. Dobson, pers. comm. 2006). Management by the Forest Service at the Miller Island site includes shared responsibility for monitoring the population with the Washington Natural Heritage Program. The Forest Service annually pulls diffuse knapweed (Centaurea diffusa), a noxious weed, from Miller Island (R. Dobson 2006). At the Grant County site, the local PUD, in coordination with the Bureau of Reclamation, monitors the population annually. The management by the two federal agencies (Forest Service and BOR) and Grant County PUD contribute to the conservation of the species; however, these actions are not sufficient to completely remove threats to the variety.

E. Other natural or manmade factors affecting its continued existence.

In addition to direct loss of habitat as a result of dam construction, the manipulation of waterflows by hydroelectric dams is a major threat to this variety. The severity of spring floods has been reduced or eliminated in most years, however, there have been years when populations become inundated for much of their growing season. At the Grant County site, the ground water that supports the plants is at a similar level to the river. Changes in the water level of the river could either desiccate or inundate this population. Manipulated water regimes do not mimic historic waterflows, which were not controlled by dams and likely were much higher during the rainy season and lower during late-summer droughts, and may affect the ability of these plants to grow, flower, reproduce, and colonize (Rush 1999). In addition, reduced peak floods and augmented minimum flows often result in the succession from herbaceous to woody vegetation (Toner and Keddy 1997) and may reduce the potential for Artemisia campestris var. wormskioldii to expand into new habitats.

Altered water regimes, as well as recreational uses and grazing, have allowed nonnative plants to invade both sites (Rush 1999). Centaurea diffusa, a Washington State class-B noxious weed (RCW 17.10, Chap 16–750) is present and spreading at the Grant County site and was found scattered throughout the Klickitat County site in 2005 (R. Dobson 2006). Noxious weed species pose a serious threat because they have the ability to displace native vegetation and outcompete native plants for resources (water and nutrients).

Linaria dalmatica, another Washington State class-B noxious weed (RCW 17.10, Chap 16–750) is present at the Grant County site (Grant County PUD 2004). As of 2004, it occupied approximately 0.5 acre and is being hand-pulled (Grant County PUD 2004). However, once established, L. dalmatica spreads quickly via its root system and by seed production. Therefore, L. dalmatica represents a serious threat at the Grant County site, as well as to the surrounding upland habitats.

Another nonnative, invasive species, Melilotus alba, partially shares habitat preferences with Artemisia campestris var. wormskioldii and occupies a small area (< 1 acre) at the Grant County site (Grant County PUD 2004). This species represents a potential threat that may develop over the long term as it begins to compete for resources with A. c. var. wormskioldii.

The extreme loss of habitat that has resulted in two small, widely separated populations may affect the viability of Artemisia campestris var. wormskioldii. Small isolated populations are more vulnerable to a variety of ecological and genetic factors, as well as naturally occurring random events (Gilpin and Soule 1986; Schemske et al. 1994). Stochastic events associated with highly variable weather, including flooding or drought, could cause extirpation of this variety.

Threats that are increasingly significant in smaller populations are related to the loss of genetic variability due to random changes in gene frequencies (genetic drift). Loss of genetic variability can affect disease resistance, response to climatic change, and reproductively compatible gene combinations (genotypes) (Hamrick and Godt 1996). Small populations are more susceptible to inbreeding, which can lead to reduced fitness of offspring (Lande and Barrowclough 1987; Ledig 1986). Crosses between closely related individuals may lead to reduced seed production due to insufficient numbers of genetically compatible individuals and low seed germination success (Richards 2000).

Both populations are threatened by recreational trampling. The peninsula or "islands" at Beverly and the boat landing site at Miller Island show sign of trampling of A. campestris var. wormskioldii plants (R. Dobson pers. comm. 2006). Recreational use of the areas associated with each of the populations also serves as a vector to the spread of nonnative plants, which can be transported to the site on boats or the footwear of recreational users.

Both Artemisia campestris var. scouleriana and A. ludoviciana occur at the Klickitat County site. There may be occasional hybridization of both taxa with A. c. var. wormskioldii (F. Caplow, pers. comm. 2004).

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The Washington Natural Heritage Program, using funding provided under section 6 of the Act, prepared a conservation strategy and monitoring plan for Artemisia campestris var. wormskioldii (Rush 1999). Management objectives include identifying and scheduling management actions that will remove or limit threats to this variety. The primary conservation goals of this plan are to protect existing populations and habitat and to maintain occupied and potential habitat in a condition that will sustain Artemisia campestris var. wormskioldii. Fencing of the Beverly population, active management to remove nonnative, invasive plant species, the collection of seed and the monitoring of the population have contributed to the incremental recovery of the population. The storing of seeds in a Center for Plant Conservation facility allows for testing of the germination potential of the variety and contributes to recovery by producing plants that could be outplanted into each of the populations.

The Washington Natural Heritage Program has obtained funding under section 6 of the Act to prepare a Conservation Agreement with the Forest Service and FWS for the Klickitat County population (F. Caplow, pers. comm. 2005).

The Washington Natural Heritage Program conducted demographic monitoring of the Miller Island population from 2002 through 2004. This monitoring effort will continue through at least 2010 in order to adequately identify trends and threats to the population.

At the Grant County site, Grant County PUD is still involved in relicensing of Priest Rapids and Wanapum Dams (M. Clement, Grant County PUD, pers. comm. 2006). The relicensing effort involves developing conservation planning for this candidate species as well as the listed bull trout (Salvelinus confluentus), chinook salmon (Oncorhynchus tshawytscha) and steelhead (Oncorhynchus mykiss) that are known to inhabit this reach of the Columbia River (Jeff Chan, FWS, pers. comm. 2006 and NOAA 2006). As part of this process, Grant County has begun to develop a Conservation Agreement with the WDNR and the Service (F. Caplow, pers. comm. 2004; T. Dresser, Grant County PUD, pers. comm. 2004). Grant County PUD began demographic monitoring and population modeling of Artemisia campestris var. wormskioldii in 2001 and will continue this effort through 2010 (Grant County PUD 2004). Grant County PUD is also working with the Bureau of Reclamation to reduce the impacts from recreational use by limiting public access to the area by maintaining the fence that was constructed around the largest population of the variety and by discouraging motorized or overnight use of the Beverly peninsulas (Grant County PUD 2004). Grant County PUD has begun implementing weed control (hand pulling) to remove diffuse knapweed, yellow starthistle (Centaurea solstitialis), cheatgrass (Bromus tectorum), and dalmation toadflax.

Grant County PUD has collected seed from the Beverly population and deposited them into the Center for Plant Conservation facility at the Berry Botanic Garden, Portland, Oregon (T. Dresser, pers. comm. 2004). Grant County PUD and Washington Natural Heritage Program staff collected 20 flowering plants of Artemisia campestris var. wormskioldii and A. c. var. scoulariana to compare seed production and viability (M. Clement, pers. comm. 2005). In addition, 45 greenhouse-grown A. c. var. wormskioldii plants were outplanted within the fenced area at the Beverly site in March 2004. As of June 2005, 36 of the plants have survived and four plants were flowering (M. Clement, pers. comm. 2005). These plants will be monitored through April 2006 in order to assess their survival and growth (M. Clement, pers. comm. 2005).

SUMMARY OF THREATS (including reasons for addition or removal from candidacy, if appropriate)

Only two widely separated populations exist for this variety. Direct loss of suitable habitat through regulation of water levels in the Columbia River and placement of riprap along the river bank has occurred at both the Klickitat and Grant County sites. Recreational use that results in trampling of plants is a threat at both sites. Competition with nonnative invasive species occurs and is a threat at both sites. Both sites have a small population size that makes them susceptible to genetic drift and inbreeding that could lead to poor seed production and low seed germination success (Richards 2000).

At the Klickitat County site, erosion of sandy substrate is the primary threat to Artemisia campestris var. wormskioldii. Recreational use at this site is not controlled or minimized

through fencing or signage and one heavy-use weekend could extirpate this population or severely trample the plants. Invasion by nonnative plant species is a major threat to A. campestris var. wormskioldii at the Klickitat County population.

A major threat to the Grant County population is the reduced water levels in the Columbia River, either through control of the water level at the dams or from lack of water and would likely result in plant desiccation because the water level would be below root level. High water events that require water releases from dams may flood or inundate this population which could affect the ability of the variety to grow, flower, reproduce or expand into unoccupied habitat.

For species that are being removed from candidate status:
___Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

RECOMMENDED CONSERVATION MEASURES

Klickitat County site:
Control nonnative, invasive plant species
Discourage recreational use
Investigate measures to reduce erosion of the sandy substrate
Augment population through seed collection and outplanting
Continue demographic monitoring through 2010.

Grant County site:
Develop conservation easement with Bureau of Reclamation
Augment population through seed collection and outplanting

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	2
		Subspecies/population	**3***
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
		Monotypic genus	10

	Non-imminent	Species Subspecies/population	11 12

Rationale for listing priority number:

Magnitude: Only two widely separated populations exist for this variety. Because of the relatively small size of the populations and their small spatial distribution, a single disturbance, such as the spread of nonnative, invasive plants or high recreational use, could eliminate one or both populations. Threats that would be considered moderate to low for a widespread species could represent higher threats to these small disjunct populations.

Imminence: High water flows, as occurred in 1996−1997, are random, naturally occurring events that may occur unpredictably in any year. During years of low flows when soil water becomes low, desiccation is a threat. There is ongoing human access for recreational purposes that threaten both populations. Invasive nonnative plant species occur at both sites, threatening the variety by competing for space, light and nutrients. Therefore, threats to this variety continue to be imminent.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. Both populations are on Federal land and are being monitored. The Grant County population has been fenced to prevent human access. Although flooding is a threat to both populations, the separation of the two populations by intervening dams and reservoirs makes it unlikely that both would be entirely destroyed in the same flood event.

DESCRIPTION OF MONITORING

The Washington Natural Heritage program monitors this variety. The Forest Service also monitors the Klickitat County population. The Service maintains contact with the responsible agencies and species experts and annually requests their reviews and updates to the candidate assessment forms during the revision process. Relevant literature and data for this variety are obtained principally from contacts with responsible agencies, species experts and their reports. Periodic literature searches for this variety are also ongoing. Because of the limited number of sites, and few responsible agencies, and species experts, this approach is the most effective for monitoring this species.

COORDINATION WITH STATES

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: Washington

Indicate which State(s) did not provide any information or comments: NA

LITERATURE CITED

Caplow, F. 2005. Demographic monitoring of northern wormwood (Artemisia campestris var. wormskioldii). Natural Heritage Report 2005-02 prepared for U.S. Fish and Wildlife Service, Region 1. Washington Natural Heritage Program, Department of Natural Resources, Olympia. 12 pp.

Carlson, M. 1997. Status report for Artemisia campestris var. wormskioldii (Bess.) Crone. Unpublished Report. Washington Natural Heritage Program, Department of Natural Resources, Olympia. 30 pp.

Center for Biological Diversity, et al. 2004. Petition to the Department of the Interior to place 225 candidate species on the endangered species list.

Chambers, K. L. and S. Sundberg. 2000. Oregon Vascular Plant Checklist. Asteraceae. Oregon Flora Project, Oregon State University. 36 pp.

Franklin, J.F. and C.T. Dyrness. 1988. Natural vegetation of Oregon and Washington. Oregon State University Press. 452 pp.

Gilpin, M.E., and M.E. Soule. 1986. Minimum viable populations: processes of species extinction. Pages 19−34 in Conservation biology: the science of scarcity and diversity. Sinauer Associates, Sunderland, Massachusetts.

Grant County Public Utility District (PUD) No. 2. 2004. Research Summary and Conservation Strategy for Artemisia campestris var. wormskioldii (Bess. Ex Hook.) Cronq. In the Priest Rapids Project Area. Draft Report Prepared by Devine Tarbell and Associates, Bothell, Washington. July 2004.

Hamrick, J.L. and M.J.W. Godt. 1996. Conservation genetics of endemic plant species. *In* J.C. Avise and J.L. Hamrick, editors. Conservation genetics: case histories from nature, International Thomson Publishing, New York, New York.

Hitchcock, C.L., and A. Cronquist. 1973. Flora of the Pacific Northwest. Ninth Printing 1994. University of Washington Press, Seattle. 730 pp.

Hitchcock, C.L., A. Cronquist, M. Ownbey, J.W. Thompson. 1955. Vascular plants of the Pacific Northwest, Part 5: Compositae. U. of Washington Press, Seattle.

Integrated Taxonomic Infromation System 2006. Artemisia campestris var. wormskioldii. Online document available at http://www/itis.usda.gov/index.html. Accessed 13 January 2006.

Kartesz, J. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland. Vol. 1. Checklist. Timber Press, Inc., Portland, Oregon.

Kaye, T. N. 1995. Monitoring plan for northern wormwood at Miller Island, Columbia River Gorge National Scenic Area. Unpublished Report. Oregon Department of Agriculture, Plant Conservation Biology Program. 28 pp.

Lande, R., and G.F. Barrowclough. 1987. Effective population size, genetic variation, and their use in population management. *In* M.E. Soule, editor. Viable populations for conservation. Cambridge University Press, New York, NY.

Ledig, F.T. 1986. Heterozygosity, heterosis, and fitness in outbreeding plants. *In* M.E. Soule, editor. Conservation biology: The science of scarcity and diversity, Sinaur Associates, Sunderland, Massachusetts.

National Oceanic and Atmospheric Administration. 2006. Summary of Final Listing Decisions and Extensions for West Coast Salmonids under the Endangered Species Act (ESA). 1 p.

Richards, C.M. 2000. Inbreeding depression and genetic rescue in a plant metapopulation. The American Naturalist. 155:383-394.

Rush, T. 1999. Conservation strategy and monitoring plan for Artemisia campestris var. wormskioldii (northern wormwood). Unpublished Report. Washington Natural Heritage Program, Department of Natural Resources, Olympia. 19 pp.

Schemske, D.W., B.C. Husband, M.H. Ruckelshaus, C. Goodwillie, I.M. Parker, and J.G. Bishop. 1994. Evaluating approaches to the conservation of rare and endangered plants. Ecology 75:584−606.

Toner, M., and P. Keddy. 1997. River hydrology and riparian wetlands: A predictive model for ecological assembly. Ecological Applications 7(1):236-246.

U.S. Fish and Wildlife Service. 1999. Endangered and threatened wildlife and plants; review of plant and animal taxa that are candidates or proposed for listing as endangered or threatened; annual notice of findings on recycled petitions; and annual description of progress on listing actions. Federal Register 64:57534–57547.

Washington Natural Heritage Program. 1997. Endangered, threatened and sensitive vascular plants of Washington with working lists of rare and non-vascular species. Washington Department of Natural Resources, Olympia. 62 pp.

Washington Natural Heritage Program and Bureau of Land Management, Spokane District. 1999. Field guide to selected rare vascular plants of Washington.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: Acting _____ 11/10/05
Regional Director, Fish and Wildlife Service Date

_____

Concur: _____ August 23, 2006
Director, Fish and Wildlife Service Date

Do not concur: _____ _____
Director, Fish and Wildlife Service Date

Date of annual review: _____

Conducted by: _____